duced necessarily afford partial relief or re-adjustment to somewhat remote and disconnected seats of pressure during the moments of oscillation. Similar causes in the American fields have led to the appearance of gas in wells that at first produced only oil or water, and *vice versâ*, and in some cases a renewal of commercial activity in an abandoned field has been the result of operations at some distance away.

Apart from the defects referred to, the work is worthy of praise, for the engineering details, which constitute the bulk, are given in a form convenient for reference, and it is only needful to warn technical readers against too implicit acceptance of the author's views on some still unsettled scientific problems.

CHEMISTRY OF ALKALOIDS.

The Vegetable Alkaloids, with Particular Reference to their Chemical Constitution. By Dr. Amé Pictet. From the second French edition. Rendered into English, revised and enlarged, with the author's sanction, by H. C. Biddle, Ph.D. Pp. i.–vii. and 1–505. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1904.)

THIS translation of the second edition of Pictet's "La Constitution chimique des Alcaloides végétaux," with the numerous additions made by the translator, will be welcomed by many readers, for nearly seven years have elapsed since the appearance of the original, and in the interval great advances have been made in our knowledge of the alkaloids. The book is in no sense a monograph, as references to the sources, modes of extraction and detection, and physiological properties of the alkaloids are of the briefest, attention being concentrated on their purely chemical behaviour, and the clues thus given to their constitution and synthesis. A brief survey of the history of this important group of compounds is followed by a section dealing with pyridine, quinoline, and their derivatives, including the carboxylic acids which have played so important a part in the elucidation of the molecular structure of the plant bases. The remainder of the book summarises what is known of the chemical behaviour of twenty-eight groups of alkaloids, and in a final chapter a list is given of forty-two alkaloids of unknown constitution. It should be added that numerous references to original papers are supplied in footnotes.

All attempts to define an alkaloid by reference to chemical constitution have proved to be unsatisfactory. Restriction of the term to derivatives of pyridine, as was proposed by Koenigs, would exclude morphine and the xanthine bases, such as caffeine, and its extension to cyclic bases found in plants, whilst including these alkaloids, would not embrace such substances as asparagine, choline, and trimethylamine. The author employs the term in its widest sense, and groups together as alkaloids all those substances which are directly obtained from plants and able to unite with acids to form salts.

The systematic chemical investigation of the alkaloids, dating from 1869, when the constitution of pyridine was made clear, has been pursued with a remarkable degree of success. Putting aside acyclic compounds, constitutional formulæ have been assigned to some twenty-five bases, including such well known substances as morphine, quinine, atropine, cocaine, nicotine, and caffeine; and although less is known of the molecular structure of the others, it is significant of the energy with which inquiry has been pressed in this direction, that more than one hundred alkaloids —about one-half of the number recognised as definite chemical substances—have been examined with at least some measure of success. Whether the formulæ now regarded as probable will survive in every case may be open to doubt; it is, however, a striking testimony to the success attending modern methods of unravelling molecular structure, that in the case of no fewer than twelve of the twenty-five formulæ just mentioned the constitution assigned on the basis of analytical evidence has been confirmed by the synthetical preparation of the alkaloid. Much of this work has been done since the appearance of the French edition, and reference in particular may be made to the syntheses of the belladonna and coca alkaloids, and of the xanthine bases, accounts of which have been supplied by the translator, and form, perhaps, the most interesting chapters in the book.

The translator has done his work successfully on the whole, but it is to be regretted that more attention has not been paid to the nomenclature of carbon compounds. The Chemical Society in this country—in the annual reprint of instructions to its staff of abstractors —and the Geneva Congress, have done much to associate definite suffixes with particular groups of compounds, and it may be hoped that, nowadays, no author of a chemical text-book in English on this side of the Atlantic would, for example, write "benzol" and "pyrrol" for benzene and pyrrole respectively. In a new edition the use of laboratory slang should be avoided. Expressions such as "nitrogen-methylated" (p. 135), "it does not react alkaline" (p, 143), "dimethylcytisine will add methyl iodide" (p. 180), and "as a starting substance" (p. 228) are not happily chosen; whilst curiosity is stimulated by the statement that "a decomposition similar to this [the elimination of methylamine from tropine] is effected by the destructive distillation of Hofmann" (p. 204), since details of the latter process have so far been withheld from publication.

W. P. W.

NICKEL STEELS.

Les Applications des Aciers au Nickel, avec un Appendice sur la Théorie des Aciers au Nickel. By Ch. Ed. Guillaume. Pp. vii + 215. (Paris: Gauthier-Villars, 1904.) Price 3.50 francs.

A PROMINENT feature of the progress of steel during the last quarter of a century or so is the continued advance in the discovery and ever-widening practical application of what are known to the maker as "special" steels. "Ordinary" steels contain essentially certain well defined and usually small proportions of carbon, silicon, and manganese, varied to suit specific purposes, while sulphur, phosphorus, and even arsenic, though not desired, are seldom entirely

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eliminated. "Special" steels contain other elements, or contain the ordinary elements in unusual proportions, as in the well known examples of Mushet's air-hardening tungsten steel, Hadfield's manganese steel, railway tyre chrome steels, nickel chrome armour plate steels, and so on, until at the present day, besides the elements just indicated, aluminium, copper, molybdenum, and even vanadium, which last is dearer than silver, are added to steels for commercial purposes, while other alloys are under experiment. It may well be imagined, then, with what eagerness the metallurgist turns to a monograph on any series of special steels, and particularly if it happens, as in the present case, to be written by a well known worker on the subject. Perhaps the title may mislead some general inquirers, for no doubt we are all looking for accounts of the experience of others in the innumerable applications, some experimental, some well established, of the steels of lower nickel content; but unless they were looking merely for guidance in the immediate work of manufacturing or using those steels, the feeling of disappointment would give way to one of great interest at the thorough manner in which certain properties of the steels of higher nickel content are discussed.

Practically the only steels seriously considered are those containing more than 26 per cent. of nickel. Within limits these are "reversible alloys," that is, "when they are brought to a determined temperature after having been run through any cycle of temperatures they retake sensibly the same properties." It is interesting to note that these alloys

> "take a beautiful polish, lend themselves admirably to engraving, are sufficiently elastic when cold rolled to make passable springs though sensibly inferior to those of steel hardened and tempered. Resistance to oxidation varies with the nickel content and for well polished bars it is sufficient to go up to 36 per cent. nickel in order to be able without fear to leave them lying some hours or even days in water at ordinary temperatures. The reversible alloys work well in the lathe, in the planing machine, with the file or the drill on condition that the tool be strong and the attack slow. In general, working at too great a speed makes the alloys act in the same fashion as a grindstone and produces an extremely rapid wearing of the steel tool."

The work consists of four parts and an appendix. Part i. gives the dilatation and modulus of elasticity of the reversible alloys, and goes into great detail as to the amounts and variations of these under special conditions. These properties of the alloy of least dilatation containing about 36 per cent. of nickel, and the special annealing at temperatures less than 100° C. required to bring its wonderfully low dilatation practically to zero, and to bring almost to perfection its *invariability* under the greatest extremes of atmospheric temperature known, are most carefully described. Two new terms, widely-accepted, should be noted here, *étuvage* for the low temperature annealing as distinct from *recuit,* high temperature annealing, and *invar*, an appropriate name for the alloy.

Part ii. is devoted to the application of these alloys, and particularly of invar, to the making of standards of length, and more especially for the measurement of bases in survey work (see NATURE, June 2, p. 104), with full details of the special wire standard. Part iii. treats of the uses and the limitations of the alloys in connection with chronometer pendulums, balances, and even springs. Part iv. takes sundry applications, some tried, some suggested, such as parts of levelling instruments, cathetometer and similar supports, bodies of astronomical telescopes, gravitation pendulums, balances, wires for operating signals, &c. Finally, the existence of invar, an alloy with a dilatation practically nil, suggests alloys of varying dilatations, hence special alloys (42 per cent. to 48 per cent.), with an expansion about equal to that of glass, for mounts of object glasses, incandescent lamps, Crookes's tubes, &c. In an appendix of twenty-seven pages the author gives his theory of the nickel steels. He abandons his former theory of compounds of iron and nickel, and, under the influence of MM. Osmond and Le Chatelier, works out an allotropic theory, of which space will not permit even a *résumé*.

This work is one that should be read not only by those particularly interested in the special matters with which it deals, but by all students of metals, as it forcibly drives home to the mind some of the characteristic properties of a remarkable series of alloys.

A. McW.

OUR BOOK SHELF.

Le Radium et la Radioactivité. By Paul Besson. With a preface by Dr. A. d'Arsonval. Pp. viii + 170. (Paris: Gauthier-Villars, 1904.) Price 3.75 francs.

THIS little volume is undoubtedly one of the best summaries that has yet appeared of the investigations that have followed from Becquerel's discovery, in 1896, of the radio-activity of the salts of uranium. The author has been associated with Prof. and Madame Curie in working up on a large scale the uranium residues from Joachimsthal, from which the salts of radium were commercially prepared. His account of the discovery of the radio-active elements, of their separation from the inactive elements in the ores, and of the methods employed in detecting and estimating their radio-activity, is exceedingly lucid and simple, and will appeal strongly to those who wish for a simple account of the phenomena as they presented themselves to the pioneer workers in this field of investigation. In view of the large amount of speculation that these investigations have aroused, it is one of the merits of the book that, whilst seven chapters are devoted to the description of the preparation and properties of the radio-active salts, the theoretical considerations are brought forward only in the last chapter. The disintegration theory, which at the present time dominates almost all that is written on this subject, occupies only a secondary place in the author's discussion of the source of the energy of radio-active bodies. He appears to lean rather to the view advocated by Filippo Ré in a short paper published in the *Comptes rendus* in June of last year, to the effect that the radio-active elements act as sources of energy not because they are in an unstable or explosive condition, but rather because they are still in process of formation. This view, which is derived from analogy with the liberation of energy in the solar system, has much to recommend it, as it eliminates the difficulty of accounting for the relatively slow rate at which the elements in question release the vast stores of energy which they are supposed, by the advocates of the disintegration theory, to contain.

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